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AUSTRALIA

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I, JONNE YABSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2002951688 for a patent by DBT DIESEL PTY LIMITED as filed on 25 September 2002.

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Fifth day of May 2003

J R Yabsley

JONNE YABSLEY
TEAM LEADER EXAMINATION
SUPPORT AND SALES

AUSTRALIA

Patents Act 1990

DBT Diesel Pty Limited

PROVISIONAL SPECIFICATION

Invention Title:

Turbocharged compression ignition engine

The invention is described in the following statement:

Field of the Invention

This invention relates to a turbocharged compression ignition engine. More particularly, the invention relates to components for a turbocharged compression ignition engine and to a compression ignition engine including such components.

Background of the Invention

Mining environments are clearly hazardous environments where extreme safety precautions must always be considered and upgraded. Of particular importance, are the safety measures designed with regard to the combustibility of the material being mined. Any object brought into a mine can either create a spark or simply heat up to temperatures above a critical ignition temperature which can cause explosions. This is a serious problem within coal mines, in particular, since coal dust can spontaneously ignite at temperatures of about 160°C to 170°C. This means that any object introduced into the mines must not emit flames or sparks and surfaces must remain well below critical temperatures.

Heavy machinery is used throughout the mining industry to move materials around the mines, in particular LHD (Load Haul Dump) machines. These machines require a great deal of power to move heavy loads. Ideally turbocharged engines should be used since they increase the amount of power in comparison with a naturally aspirated engine of similar capacity without suffering a significant fuel consumption disadvantage.

However, turbochargers of compression ignition engines have surface temperatures in excess of 160°C and as a result temporary measures have been implemented on and around 'hot spots' to reduce the surface temperature of the turbochargers and increase safety measures. As a consequence of the unreliable nature of this temporary method, non-turbocharged engines have been traditionally used since their surface temperatures remain below the critical temperatures, although they continue to remain inefficient in light of the present technology.

In addition to the problems associated with the surface temperatures of the turbocharger, flames or sparks emitted from the engines or travelling within the engine itself, also present a potential danger. As a result, flame traps are positioned within the engine system to arrest the transmission of flames.

At present, the arrangement is such that the flame traps are situated at the inlet of the turbocharger so that the aftercooler is situated directly off the turbocharger at a right angle. This arrangement does not optimise the space constraints within the engine and furthermore the arrangement of the flame trap, turbocharger and aftercooler do not optimise fluid flow rates within the system. Thus there is a need for improved methods to increase the efficiency and safety of the turbocharged compression ignition engine.

Summary of the Invention

According to a first aspect of the invention, there is provided a component for a turbocharger, the component including;

a housing defining a chamber for a predetermined part of the turbocharger; and

a jacket surrounding the housing, the jacket being arranged in a spaced relationship relative to an outer surface of the housing to define a fluid path about said outer surface of the housing, the fluid path having a fluid inlet and a fluid outlet.

A preferred embodiment may comprise the fluid path having the fluid outlet situated at a furthermost position from the fluid inlet, so that, in use, the effect of the cooling fluid is maximised since it may cover a larger portion of the outer surface of the housing and hence increase the efficiency of the cooling arrangement.

The housing may be a compressor housing of the turbocharger and may have an air inlet for receiving uncompressed air and an air outlet for discharging compressed air to an engine.

The jacket may be of aluminium and may be attached to the housing by welding by appropriate choice of welding techniques.

The invention extends also to a turbocharger having a component as described above.

According to a second aspect of the invention, there is provided a flame trap for a compression ignition engine, the flame trap including;

a housing having an inlet configured to engage an air outlet of a turbocharger and an outlet configured to engage an inlet of an inlet after-cooler.

The flame trap may be fluid cooled. Hence the housing of the flame trap may be double skinned having an inner skin defining a flame trap compartment and an outer skin arranged in a spaced relationship relative to the inner skin to

define a fluid path for the flow of a cooling fluid about the inner skin of the housing. The housing may define a cooling fluid inlet and a cooling fluid outlet of the fluid path.

A preferred embodiment of the flame trap housing may have the cooling fluid outlet situated at a furthermost position from the cooling fluid inlet, so that, in use, the effect of the cooling fluid is maximised since it may cover a larger portion of the inner skin surface of the flame trap housing and hence increase the efficiency of the cooling arrangement.

According to a third aspect of the invention there is provided a fluid input assembly for a compression ignition engine, the assembly including

a turbocharger;

a flame trap, as described above, connected to an outlet of the turbocharger; and

an inlet after-cooler connected to an outlet of the flame trap.

The turbocharger may include a component as described above. The fluid outlet of the jacket of the compressor housing may be in fluid communication with the cooling fluid inlet of the flame trap housing.

The invention extends still further to a compression ignition engine including a fluid input assembly as described above.

Brief Description of the Drawings

The invention is now described by way of example with reference to the accompanying drawings in which:

Figure 1 shows a side view of a fluid input assembly, in accordance with an aspect of the invention, for a compression ignition engine;

Figure 2 shows a plan view of the fluid input assembly; and

Figure 3 shows a side view of a fluid cooled turbocharged, compression ignition engine.

Detailed Description of the Invention

Referring initially to Figures 1 and 2 of the drawings, an embodiment of a fluid input assembly for a turbocharged compression ignition engine arrangement is illustrated and is generally designated by reference numeral 10.

The assembly 10 comprises a turbocharger 12 for a compression ignition engine 11 (Figure 3). The turbocharger 12 includes a housing 14 defining a chamber 16 for a predetermined part, more particularly, a compressor 18 and

the turbocharger 12. The compressor 18 comprises a plurality of radially extending blades 18.1 which draws air through an inlet 20 and expels the resulting air through an outlet 22.

The assembly 10 further comprises a flame trap 34 also in accordance with an aspect of the invention.

A jacket 24 surrounding the housing 14 of the turbocharger 12 is arranged in a spaced relationship relative to an outer surface 26 of the housing 14 to define a fluid path 28 about said outer surface of the housing, the fluid path 28 having a fluid inlet 30 and a fluid outlet 32.

A preferred embodiment comprises the fluid path 28 having the fluid outlet 32 situated at a furthermost position from the fluid inlet 30, so that, in use, the effect of the cooling fluid is maximised since it covers a larger portion of the outer surface 26 of the housing 14 and hence increases the efficiency of the cooling arrangement generally indicated at 12. As the housing 14 is substantially circular, this entails having the fluid inlet 30 and the fluid outlet 32 in about diametrically opposed positions on the jacket 24.

The flame trap 34 includes a housing 36 having an inlet 38 configured to engage the outlet 22 of the turbocharger 12 and an outlet 40 configured to engage an inlet 42 of an inlet after-cooler 44.

The flame trap 34 is fluid cooled. Hence the housing 36 of the flame trap 34 is double skinned having an inner skin 46 defining a flame trap compartment 35 and an outer skin 48 arranged in a spaced relationship relative to the inner skin 46 of the housing 36 to form a fluid path 52. The fluid path 52 defines a cooling fluid inlet 50 and a cooling fluid outlet 54.

A preferred embodiment of the flame trap housing 36 comprises the fluid path 52 having the cooling fluid outlet 54 situated at a furthermost position from the cooling fluid inlet 50, so that, in use, the effect of the cooling fluid is maximised since it covers a larger portion of the inner skin surface 46 of the flame trap housing 36 and hence increases the efficiency of the cooling arrangement.

In this embodiment of the invention, the flame trap 34 includes a body portion 58 having a first surface 60 and a spaced, second surface 62 and defining the flame trap outlet 40. The flame trap compartment 35 comprises two parallel triangular side walls 64 and 66 extending from the surface 60 of the body portion 58. The walls 64, 66 are bridged by a base member 68, which extends from the surface 60 of the body portion 58. The flame trap inlet 38 is

defined through said base member 68. An outer plate 70 completes the flame trap compartment 35 which is bounded by the walls 64, 66, the base member 68 and the plate 70.

Furthermore, said surface 62 of the body portion 58 abuts the inlet after-cooler 44. The body portion 58 provides an attachment means for attaching the flame trap 34 to the inlet after-cooler 44 using, for example, bolts 72.

The flame trap 34 acts as an elbow connecting the turbocharger 12 to the inlet after-cooler 44, and serves to trap any blow back from the compression ignition engine to inhibit escape of sparks.

In use, the fluid input assembly 10 for the compression ignition engine 11 includes the turbocharger 12, the flame trap 34 connected to an outlet 22 of the turbocharger and the inlet after-cooler 44 connected to an outlet 38 of the flame trap.

The fluid path 28 of the turbocharger 12 is in fluid communication with the fluid path 52 of the flame trap 34.

Thus, cooling fluid enters the assembly 10 through the fluid inlet 30 of the turbocharger 12, circulates through the cooling fluid path 28 and is discharged through the fluid outlet 32. The fluid path 28 of the turbocharger 12 is coupled via a suitable conduit (not shown) to the fluid path 52 of the flame trap 34 so that the fluid outlet 32 of the turbocharger 12 discharges the cooling fluid to the fluid inlet 50 of the flame trap 34. The cooling fluid circulates through the fluid path 52 of the flame trap 34 and is discharged through the fluid outlet 54 back into a cooling system of the engine 11.

The fluid input assembly 10 is shown, in use, mounted on the compression ignition engine 11 in Figure 3 of the drawings. The air is injected into the turbocharger 12 via the air inlet 20 from an inlet manifold 74. The compressed air is discharged from the turbocharger 12 via the outlet 22 to the flame trap 34. The compressed air is then injected into the engine 11 via the inlet after-cooler 44.

The engine 11 is cooled by a cooling system 76, having a radiator 78 and a cooling fan 80 which is controlled by a fan motor 82. Cooling fluid circulating through the fluid input assembly 10 is fed back into the cooling system 76.

An advantage of the invention is that a fluid input assembly 10 is provided which the applicant believes will operate at a temperature lower than

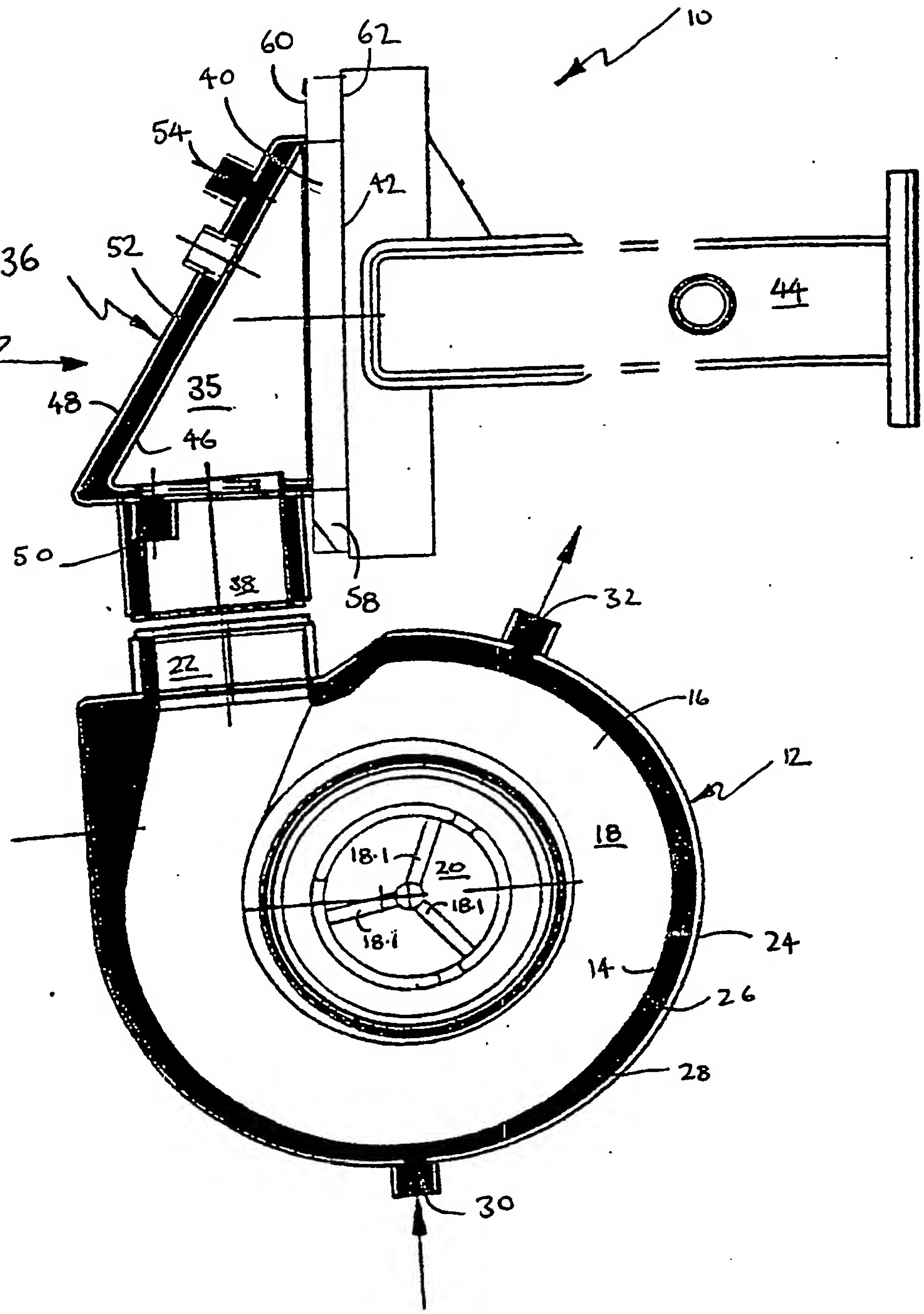
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Figure 1

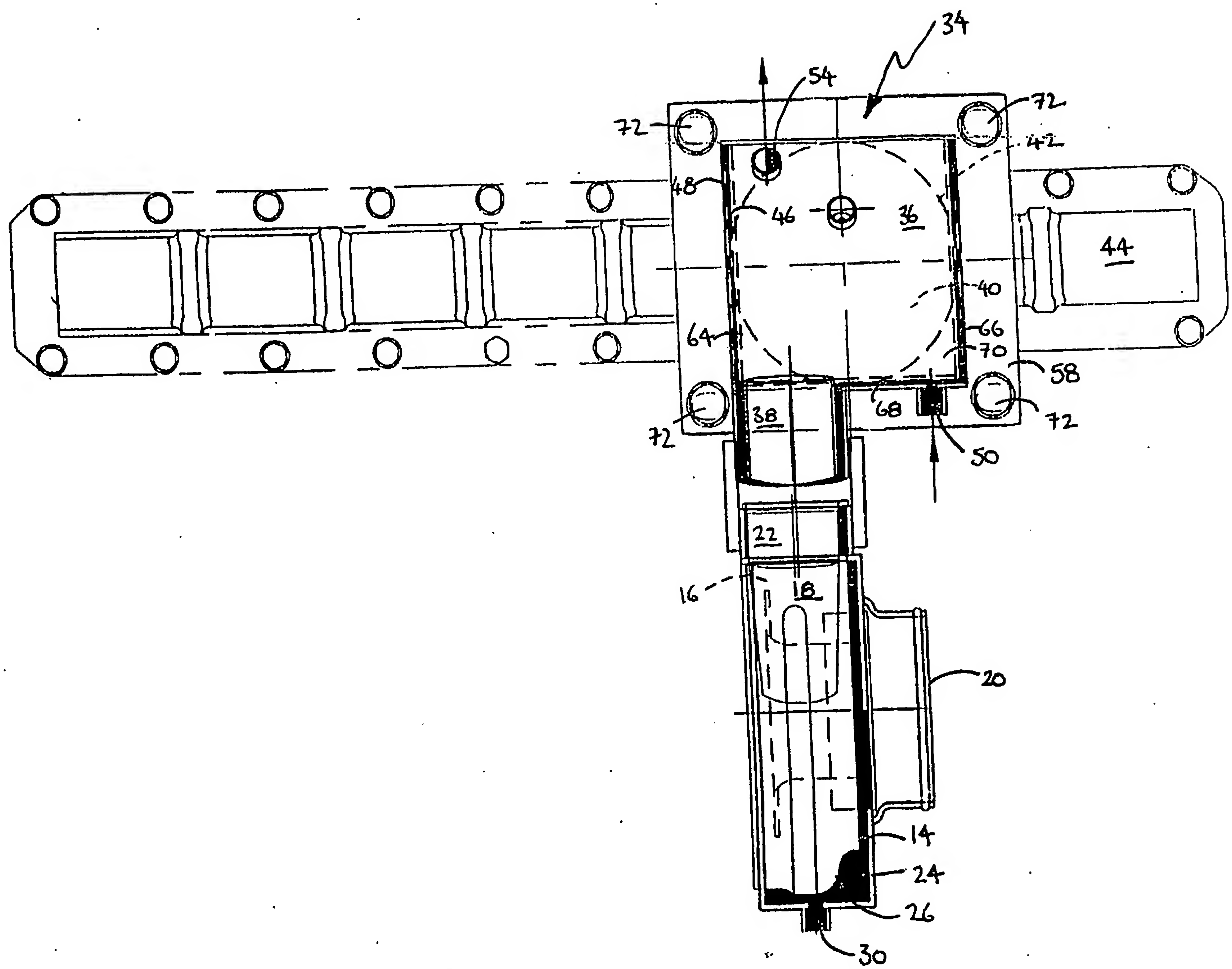
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FIGURE 2

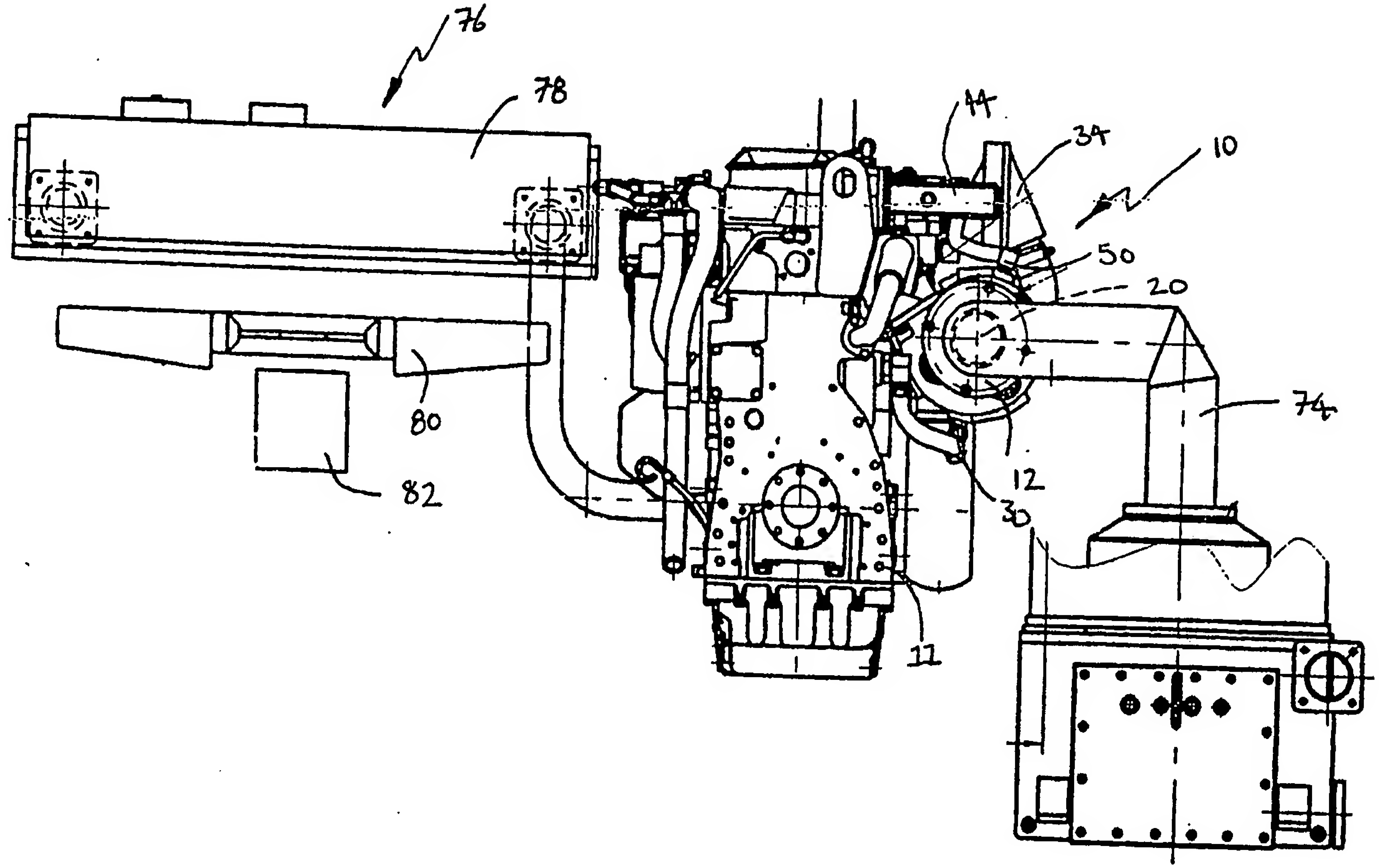

FIGURE 3

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Turbocharged compression ignition engine

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Field of the Invention

This invention relates to a turbocharged compression ignition engine. More particularly, the invention relates to components for a turbocharged compression ignition engine and to a compression ignition engine including such components.

Background of the Invention

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Heavy machinery is used throughout the mining industry to move materials around the mines, in particular LHD (Load Haul Dump) machines. These machines require a great deal of power to move heavy loads. Ideally turbocharged engines should be used since they increase the amount of power in comparison with a naturally aspirated engine of similar capacity without suffering a significant fuel consumption disadvantage.

However, turbochargers of compression ignition engines have surface temperatures in excess of 160°C and as a result temporary measures have been implemented on and around 'hot spots' to reduce the surface temperature of the turbochargers and increase safety measures. As a consequence of the unreliable nature of this temporary method, non-turbocharged engines have been traditionally used since their surface temperatures remain below the critical temperatures, although they continue to remain inefficient in light of the present technology.

In addition to the problems associated with the surface temperatures of the turbocharger, flames or sparks emitted from the engines or travelling within the engine itself, also present a potential danger. As a result, flame traps are positioned within the engine system to arrest the transmission of flames.

At present, the arrangement is such that the flame traps are situated at the inlet of the turbocharger so that the aftercooler is situated directly off the turbocharger at a right angle. This arrangement does not optimise the space constraints within the engine and furthermore the arrangement of the flame trap, turbocharger and aftercooler do not optimise fluid flow rates within the system. Thus there is a need for improved methods to increase the efficiency and safety of the turbocharged compression ignition engine.

Summary of the Invention

According to a first aspect of the invention, there is provided a component for a turbocharger, the component including;

a housing defining a chamber for a predetermined part of the turbocharger; and

a jacket surrounding the housing, the jacket being arranged in a spaced relationship relative to an outer surface of the housing to define a fluid path about said outer surface of the housing, the fluid path having a fluid inlet and a fluid outlet.

A preferred embodiment may comprise the fluid path having the fluid outlet situated at a furthermost position from the fluid inlet, so that, in use, the effect of the cooling fluid is maximised since it may cover a larger portion of the outer surface of the housing and hence increase the efficiency of the cooling arrangement.

The housing may be a compressor housing of the turbocharger and may have an air inlet for receiving uncompressed air and an air outlet for discharging compressed air to an engine.

The jacket may be of aluminium and may be attached to the housing by welding by appropriate choice of welding techniques.

The invention extends also to a turbocharger having a component as described above.

According to a second aspect of the invention, there is provided a flame trap for a compression ignition engine, the flame trap including;

a housing having an inlet configured to engage an air outlet of a turbocharger and an outlet configured to engage an inlet of an inlet after-cooler.

The flame trap may be fluid cooled. Hence the housing of the flame trap may be double skinned having an inner skin defining a flame trap compartment and an outer skin arranged in a spaced relationship relative to the inner skin to

define a fluid path for the flow of a cooling fluid about the inner skin of the housing. The housing may define a cooling fluid inlet and a cooling fluid outlet of the fluid path.

A preferred embodiment of the flame trap housing may have the cooling fluid outlet situated at a furthermost position from the cooling fluid inlet, so that, in use, the effect of the cooling fluid is maximised since it may cover a larger portion of the inner skin surface of the flame trap housing and hence increase the efficiency of the cooling arrangement.

According to a third aspect of the invention there is provided a fluid input assembly for a compression ignition engine, the assembly including

a turbocharger;

a flame trap, as described above, connected to an outlet of the turbocharger; and

an inlet after-cooler connected to an outlet of the flame trap.

The turbocharger may include a component as described above. The fluid outlet of the jacket of the compressor housing may be in fluid communication with the cooling fluid inlet of the flame trap housing.

The invention extends still further to a compression ignition engine including a fluid input assembly as described above.

Brief Description of the Drawings

The invention is now described by way of example with reference to the accompanying drawings in which:

Figure 1 shows a side view of a fluid input assembly, in accordance with an aspect of the invention, for a compression ignition engine;

Figure 2 shows a plan view of the fluid input assembly; and

Figure 3 shows a side view of a fluid cooled turbocharged, compression ignition engine.

Detailed Description of the Invention

Referring initially to Figures 1 and 2 of the drawings, an embodiment of a fluid input assembly for a turbocharged compression ignition engine arrangement is illustrated and is generally designated by reference numeral 10.

The assembly 10 comprises a turbocharger 12 for a compression ignition engine 11 (Figure 3). The turbocharger 12 includes a housing 14 defining a chamber 16 for a predetermined part, more particularly, a compressor 18 and

the turbocharger 12. The compressor 18 comprises a plurality of radially extending blades 18.1 which draws air through an inlet 20 and expels the resulting air through an outlet 22.

The assembly 10 further comprises a flame trap 34 also in accordance with an aspect of the invention.

A jacket 24 surrounding the housing 14 of the turbocharger 12 is arranged in a spaced relationship relative to an outer surface 26 of the housing 14 to define a fluid path 28 about said outer surface of the housing, the fluid path 28 having a fluid inlet 30 and a fluid outlet 32.

A preferred embodiment comprises the fluid path 28 having the fluid outlet 32 situated at a furthermost position from the fluid inlet 30, so that, in use, the effect of the cooling fluid is maximised since it covers a larger portion of the outer surface 26 of the housing 14 and hence increases the efficiency of the cooling arrangement generally indicated at 12. As the housing 14 is substantially circular, this entails having the fluid inlet 30 and the fluid outlet 32 in about diametrically opposed positions on the jacket 24.

The flame trap 34 includes a housing 36 having an inlet 38 configured to engage the outlet 22 of the turbocharger 12 and an outlet 40 configured to engage an inlet 42 of an inlet after-cooler 44.

The flame trap 34 is fluid cooled. Hence the housing 36 of the flame trap 34 is double skinned having an inner skin 46 defining a flame trap compartment 35 and an outer skin 48 arranged in a spaced relationship relative to the inner skin 46 of the housing 36 to form a fluid path 52. The fluid path 52 defines a cooling fluid inlet 50 and a cooling fluid outlet 54.

A preferred embodiment of the flame trap housing 36 comprises the fluid path 52 having the cooling fluid outlet 54 situated at a furthermost position from the cooling fluid inlet 50, so that, in use, the effect of the cooling fluid is maximised since it covers a larger portion of the inner skin surface 46 of the flame trap housing 36 and hence increases the efficiency of the cooling arrangement.

In this embodiment of the invention, the flame trap 34 includes a body portion 58 having a first surface 60 and a spaced, second surface 62 and defining the flame trap outlet 40. The flame trap compartment 35 comprises two parallel triangular side walls 64 and 66 extending from the surface 60 of the body portion 58. The walls 64, 66 are bridged by a base member 68, which extends from the surface 60 of the body portion 58. The flame trap inlet 38 is

defined through said base member 68. An outer plate 70 completes the flame trap compartment 35 which is bounded by the walls 64, 66, the base member 68 and the plate 70.

Furthermore, said surface 62 of the body portion 58 abuts the inlet after-cooler 44. The body portion 58 provides an attachment means for attaching the flame trap 34 to the inlet after-cooler 44 using, for example, bolts 72.

The flame trap 34 acts as an elbow connecting the turbocharger 12 to the inlet after-cooler 44, and serves to trap any blow back from the compression ignition engine to inhibit escape of sparks.

In use, the fluid input assembly 10 for the compression ignition engine 11 includes the turbocharger 12, the flame trap 34 connected to an outlet 22 of the turbocharger and the inlet after-cooler 44 connected to an outlet 38 of the flame trap.

The fluid path 28 of the turbocharger 12 is in fluid communication with the fluid path 52 of the flame trap 34.

Thus, cooling fluid enters the assembly 10 through the fluid inlet 30 of the turbocharger 12, circulates through the cooling fluid path 28 and is discharged through the fluid outlet 32. The fluid path 28 of the turbocharger 12 is coupled via a suitable conduit (not shown) to the fluid path 52 of the flame trap 34 so that the fluid outlet 32 of the turbocharger 12 discharges the cooling fluid to the fluid inlet 50 of the flame trap 34. The cooling fluid circulates through the fluid path 52 of the flame trap 34 and is discharged through the fluid outlet 54 back into a cooling system of the engine 11.

The fluid input assembly 10 is shown, in use, mounted on the compression ignition engine 11 in Figure 3 of the drawings. The air is injected into the turbocharger 12 via the air inlet 20 from an inlet manifold 74. The compressed air is discharged from the turbocharger 12 via the outlet 22 to the flame trap 34. The compressed air is then injected into the engine 11 via the inlet after-cooler 44.

The engine 11 is cooled by a cooling system 76, having a radiator 78 and a cooling fan 80 which is controlled by a fan motor 82. Cooling fluid circulating through the fluid input assembly 10 is fed back into the cooling system 76.

An advantage of the invention is that a fluid input assembly 10 is provided which the applicant believes will operate at a temperature lower than

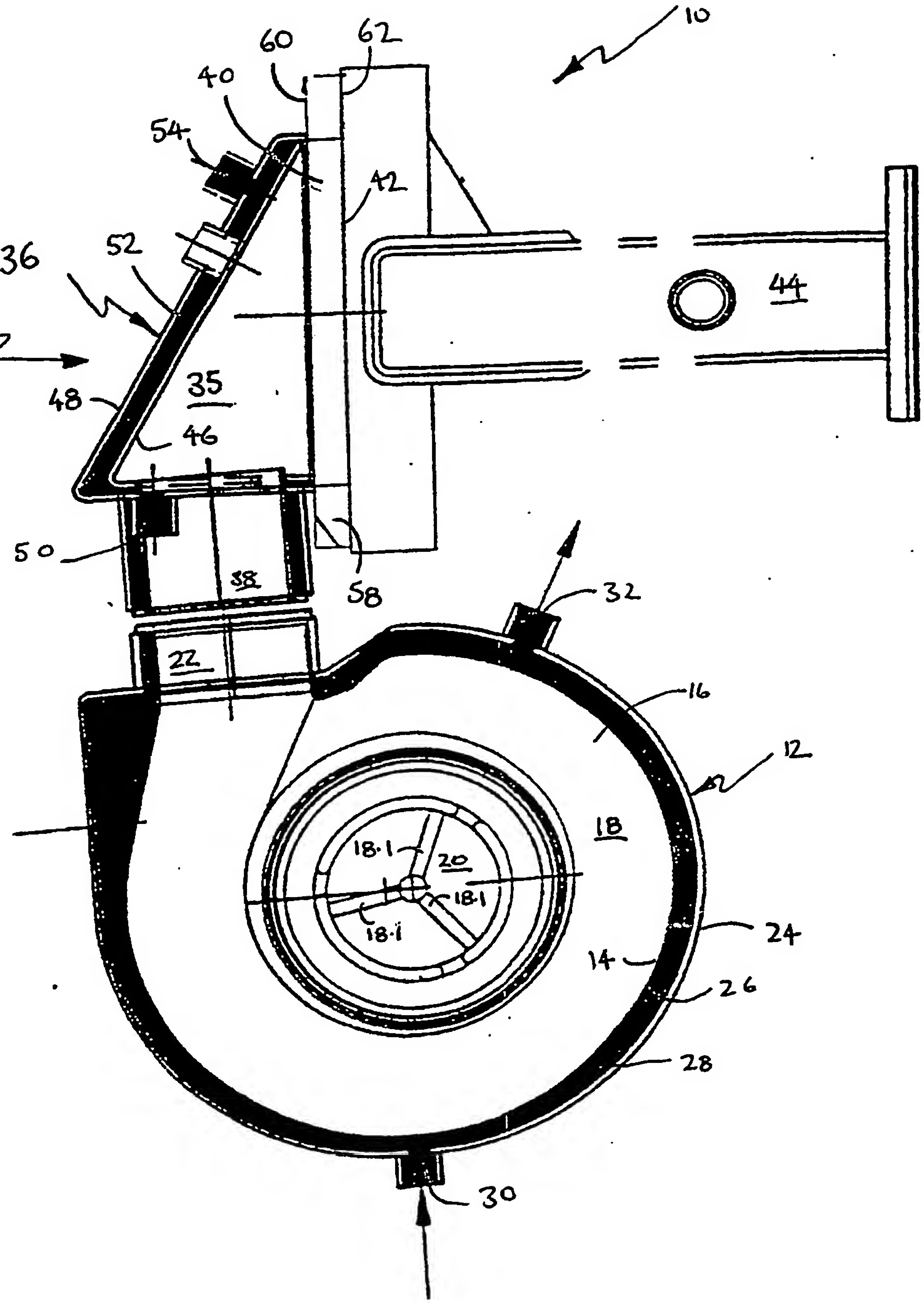

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Figure 1

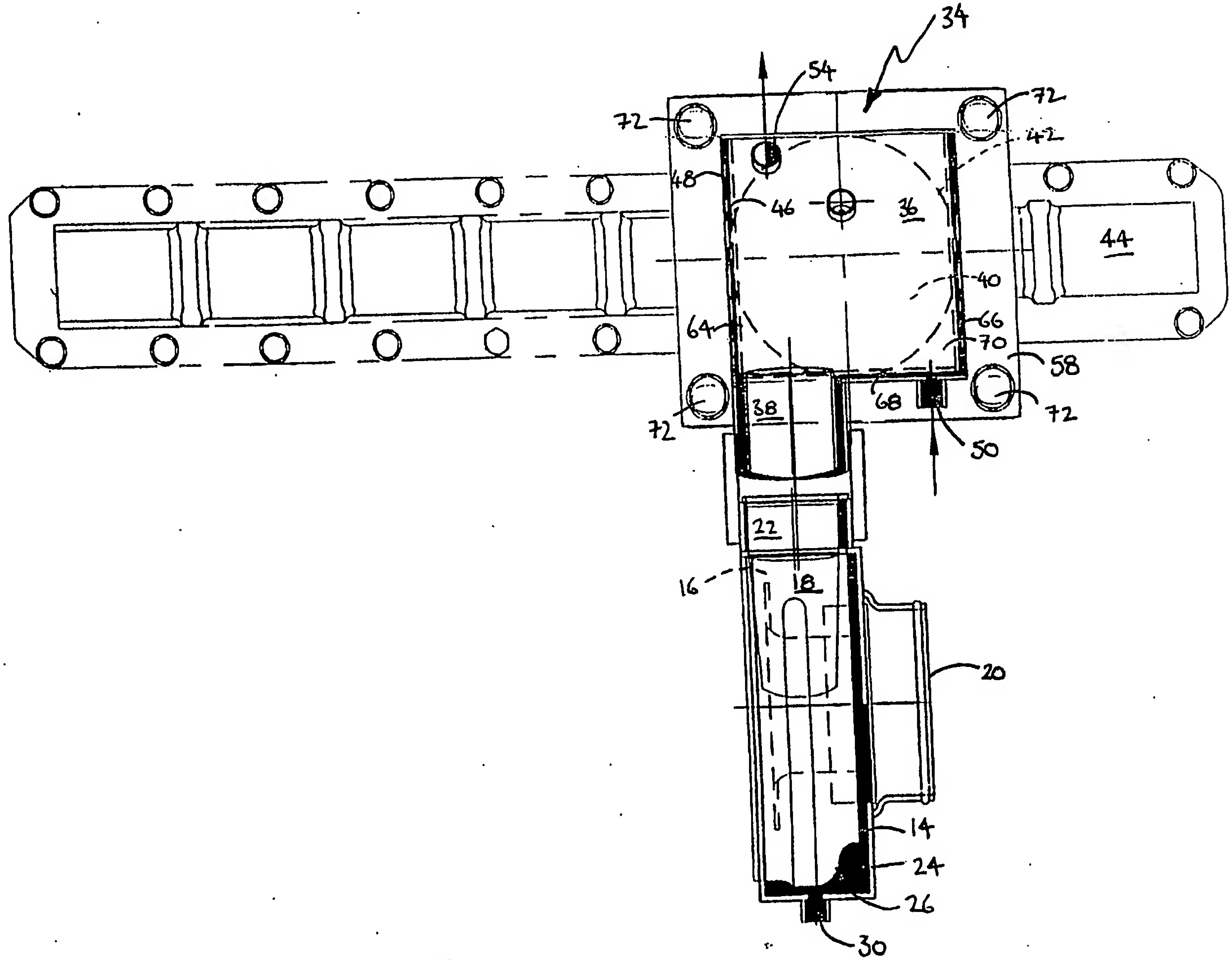
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FIGURE 2

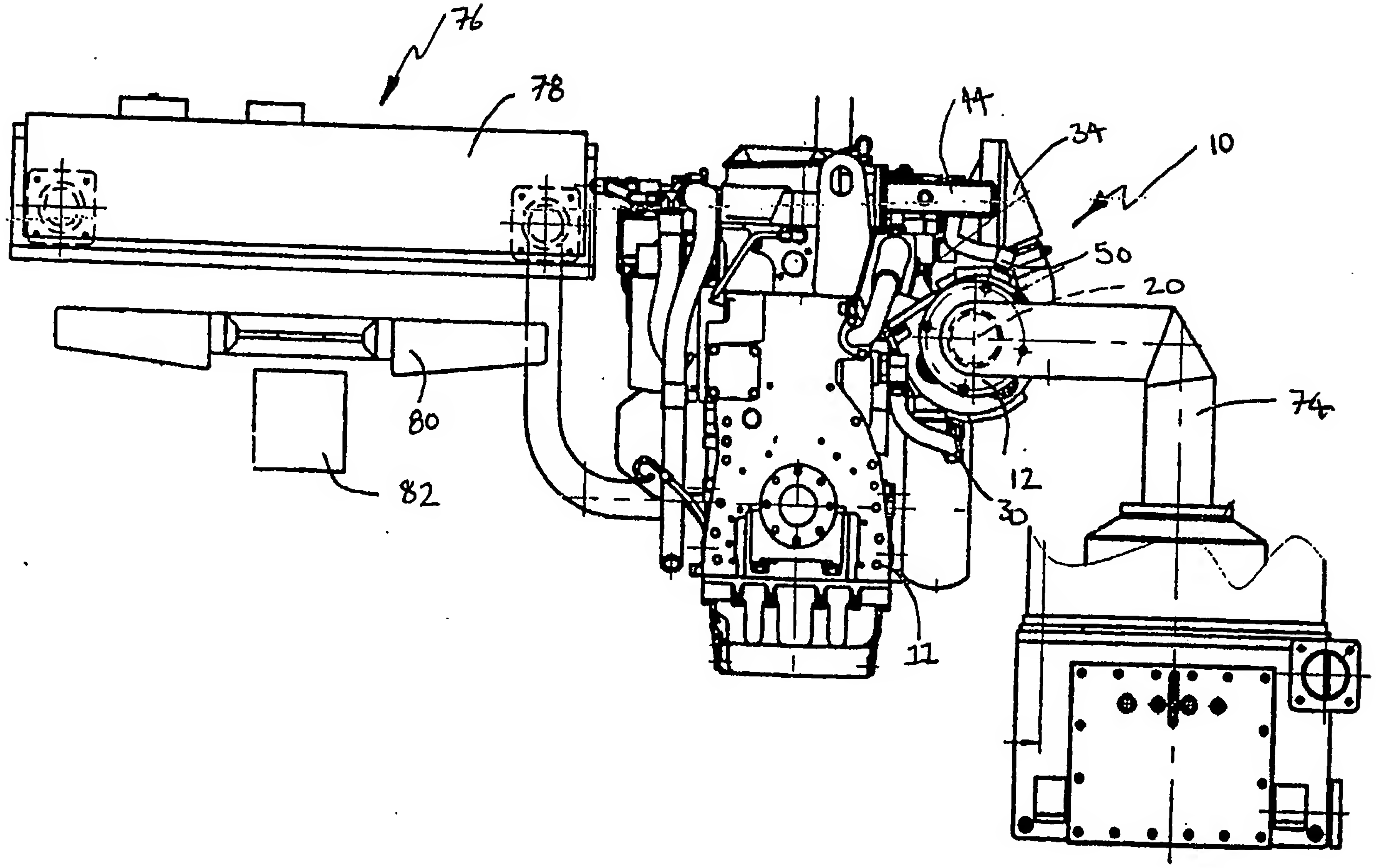

FIGURE 3